



WORKSHEET

Data Representation Question – Stem and Leaf Diagrams

Question Description: Every year in your Statistics 1 exam there is a question on Representing Data. Below are all the exam questions when they ask you to represent data by drawing a “Stem and Leaf diagram”.

QUESTIONS

Q1 w2015_p62

The weights, in kilograms, of the 15 rugby players in each of two teams, *A* and *B*, are shown below.

Team <i>A</i>	97	98	104	84	100	109	115	99	122	82	116	96	84	107	91
Team <i>B</i>	75	79	94	101	96	77	111	108	83	84	86	115	82	113	95

- (i) Represent the data by drawing a back-to-back stem-and-leaf diagram with team *A* on the left-hand side of the diagram and team *B* on the right-hand side. [4]
- (ii) Find the interquartile range of the weights of the players in team *A*. [2]
- (iii) A new player joins team *B* as a substitute. The mean weight of the 16 players in team *B* is now 93.9 kg. Find the weight of the new player. [3]

Q2 s2016_p62

The following are the maximum daily wind speeds in kilometres per hour for the first two weeks in April for two towns, Bronlea and Rogate.

Bronlea	21	45	6	33	27	3	32	14	28	24	13	17	25	22
Rogate	7	5	4	15	23	7	11	13	26	18	23	16	10	34

- (i) Draw a back-to-back stem-and-leaf diagram to represent this information. [5]
- (ii) Write down the median of the maximum wind speeds for Bronlea and find the interquartile range for Rogate. [3]
- (iii) Use your diagram to make one comparison between the maximum wind speeds in the two towns. [1]

Q3 w2016_p61

The masses, in grams, of components made in factory *A* and components made in factory *B* are shown below.

Factory <i>A</i>	0.049	0.050	0.053	0.054	0.057	0.058	0.058
	0.059	0.061	0.061	0.061	0.063	0.065	
Factory <i>B</i>	0.031	0.056	0.049	0.044	0.038	0.048	0.051
	0.064	0.035	0.042	0.047	0.054	0.058	

- (i) Draw a back-to-back stem-and-leaf diagram to represent the masses of components made in the two factories. [5]
- (ii) Find the median and the interquartile range for the masses of components made in factory *B*. [3]
- (iii) Make two comparisons between the masses of components made in factory *A* and the masses of those made in factory *B*. [2]

Q4 w2017_p63

The number of Olympic medals won in the 2012 Olympic Games by the top 27 countries is shown below.

104	88	82	65	44	38	35	34	28
28	18	18	17	17	14	13	13	12
12	10	10	10	9	6	5	2	2

- (i) Draw a stem-and-leaf diagram to illustrate the data. [4]

Q5 w2018_p63

The heights, in cm, of the 11 members of the Anvils athletics team and the 11 members of the Brecons swimming team are shown below.

Anvils	173	158	180	196	175	165	170	169	181	184	172
Brecons	166	170	171	172	172	178	181	182	183	183	192

- (i) Draw a back-to-back stem-and-leaf diagram to represent this information, with Anvils on the left-hand side of the diagram and Brecons on the right-hand side. [4]

- (ii) Find the median and the interquartile range for the heights of the Anvils. [3]

The heights of the 11 members of the Anvils are denoted by x cm. It is given that $\Sigma x = 1923$ and $\Sigma x^2 = 337\,221$. The Anvils are joined by 3 new members whose heights are 166 cm, 172 cm and 182 cm.

- (iii) Find the standard deviation of the heights of all 14 members of the Anvils. [4]

Q6 s2019_p63

The times in minutes taken by 13 pupils at each of two schools in a cross-country race are recorded in the table below.

Thaters School	38	43	48	52	54	56	57	58	58	61	62	66	75
Whitefay Park School	45	47	53	56	56	61	64	66	69	73	75	78	83

- (i) Draw a back-to-back stem-and-leaf diagram to illustrate these times with Thaters School on the left. [4]

- (ii) Find the interquartile range of the times for pupils at Thaters School. [2]

The times taken by pupils at Whitefay Park School are denoted by x minutes.

- (iii) Find the value of $\Sigma(x - 60)^2$. [2]

- (iv) It is given that $\Sigma(x - 60) = 46$. Use this result, together with your answer to part (iii), to find the variance of x . [2]

ANSWERS

Q1

(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">team <i>A</i></th><th></th><th style="text-align: center;">team <i>B</i></th></tr> </thead> <tbody> <tr><td></td><td style="text-align: center;">7</td><td style="text-align: center;">5 7 9</td></tr> <tr><td style="text-align: center;">4 4 2</td><td style="text-align: center;">8</td><td style="text-align: center;">2 3 4 6</td></tr> <tr><td style="text-align: center;">9 8 7 6 1</td><td style="text-align: center;">9</td><td style="text-align: center;">4 5 6</td></tr> <tr><td style="text-align: center;">9 7 4 0</td><td style="text-align: center;">10</td><td style="text-align: center;">1 8</td></tr> <tr><td style="text-align: center;">6 5</td><td style="text-align: center;">11</td><td style="text-align: center;">1 3 5</td></tr> <tr><td style="text-align: center;">2</td><td style="text-align: center;">12</td><td></td></tr> </tbody> </table> key 1 9 4 means 91 kg for team <i>A</i> and 94 kg for <i>B</i>	team <i>A</i>		team <i>B</i>		7	5 7 9	4 4 2	8	2 3 4 6	9 8 7 6 1	9	4 5 6	9 7 4 0	10	1 8	6 5	11	1 3 5	2	12		B1 Correct stem can be upside down, ignore extra values, allow 70, 80 etc with suitable numerical key B1 Correct team <i>A</i> must be on LHS, alignment $\pm$ half a space, no late entries squeezed in, no crossing out if shape is changed B1 Correct team <i>B</i> in single diagram can be either LHS or RHS B1 4 Correct key or keys for their diagram/s, need both teams, at least one kg.
team <i>A</i>		team <i>B</i>																					
	7	5 7 9																					
4 4 2	8	2 3 4 6																					
9 8 7 6 1	9	4 5 6																					
9 7 4 0	10	1 8																					
6 5	11	1 3 5																					
2	12																						
(ii)	LQ = 91 UQ = 109 IQ range = 18	B1 Both quartiles correct B1^h 2 Correct IQR ft wrong quartiles, LQ < UQ, not 12 – 4 etc																					
(iii)	$\Sigma x_{15} = 1399$ $\Sigma x_{16} = 16 \times 93.9 = 1502.4$ New wt = $1502.4 - 1399 = 103$ (103.4)	M1 Attempt at Σx_{15} for either team M1 Mult 93.9 by 16 attempt A1 3 Correct answer																					

Q2

(i)	Bronlea Rogate 6 3 0 4 5 7 7 7 4 3 1 0 1 3 5 6 8 8 7 5 4 2 1 2 3 3 6 3 2 3 4 5 4	B1 Correct single stem B1 Correct ordered leaves Bronlea B1 Correct ordered leaves Rogate
	Key 3 1 5 represents 13 kph for Bronlea and 15 kph for Rogate	B1 [5] Single key must have both towns and units consistent with their values
	(ii) median Bronlea = 23 km per hour IQ range Rogate = 23 – 7 = 16	B1 Units not necessary M1 Subt their LQ <14 from their UQ>14 from Rogate leaf A1 [3]
	(iii) Rogate is less windy than Bronlea	B1 [1] Not a comparison of a statistic but interpretation of information

Q3

(i)	<table><tr><th>Factory <i>A</i></th><th></th><th>Factory <i>B</i></th></tr><tr><td></td><td>3</td><td>1 5 8</td></tr><tr><td>9</td><td>4</td><td>2 4 7 8 9</td></tr><tr><td>9 8 8 7 4 3 0</td><td>5</td><td>1 4 6 8</td></tr><tr><td>5 3 1 1 1</td><td>6</td><td>4</td></tr></table>	Factory <i>A</i>		Factory <i>B</i>		3	1 5 8	9	4	2 4 7 8 9	9 8 8 7 4 3 0	5	1 4 6 8	5 3 1 1 1	6	4	M1		Attempt at ordering factory <i>B</i>
	Factory <i>A</i>		Factory <i>B</i>																
		3	1 5 8																
	9	4	2 4 7 8 9																
	9 8 8 7 4 3 0	5	1 4 6 8																
5 3 1 1 1	6	4																	
		B1		Correct stem															
		B1		Correct leaves factory <i>A</i>															
	Key: 9 4 2 represents 0.049g for factory <i>A</i> and 0.042 g for factory <i>B</i>	B1		Correct leaves factory <i>B</i>															
		B1	[5]	Correct key need factory <i>A</i> and factory <i>B</i> and units															
(ii)	median factory <i>B</i> = 0.048 g	B1		using their key i.e. 48, 0.48 etc or correct															
	IQR = UQ – LQ = 0.055 – 0.04	M1		Subt their LQ from their UQ for factory <i>B</i>															
	= 0.015	A1	[3]																
(iii)	generally heavier in factory <i>A</i>	B1		oe															
	Masses more spread out in factory <i>B</i>	B1	[2]	must refer to context, e.g. mass															

Q4

(i)			B1	Stem, digits 5, 7, 9 can be missing here, can be upside down
	0	2 2 5 6 9	B1	All leaves in correct order increasing from stem, (5, 7 and 9 can be missing), condone commas
	1	0 0 0 2 2 3 3 4 7 7 8 8		
	2	8 8	B1	Reasonable shape, requires all values of the stem, only one line for each stem and leaves must be lined up. Can be upside down or sideways. No commas. Condone one 'leaf' error.
	3	4 5 8		
	4	4	B1	Correct key must state 'medals' or have 'medals' in leaf heading or title
	5			
	6	5		
	7			
	8	2 8		
9				
10	4	key 2 8 means 28 medals	4	

Q5

(i)	<table><tr><th>Anvils</th><th></th><th>Brecons</th></tr><tr><td>8</td><td>15</td><td></td></tr><tr><td>9 5</td><td>16</td><td>6</td></tr><tr><td>5 3 2 0</td><td>17</td><td>0 1 2 2 8</td></tr><tr><td>4 1 0</td><td>18</td><td>1 2 3 3</td></tr><tr><td>6</td><td>19</td><td>2</td></tr><tr><td colspan="3">Key: 5 16 6 means 165 cm for Anvils and 166 cm for Brecons</td></tr></table>	Anvils		Brecons	8	15		9 5	16	6	5 3 2 0	17	0 1 2 2 8	4 1 0	18	1 2 3 3	6	19	2	Key: 5 16 6 means 165 cm for Anvils and 166 cm for Brecons			B1	Correct stem, up or down
	Anvils		Brecons																					
	8	15																						
	9 5	16	6																					
	5 3 2 0	17	0 1 2 2 8																					
4 1 0	18	1 2 3 3																						
6	19	2																						
Key: 5 16 6 means 165 cm for Anvils and 166 cm for Brecons																								
		B1	Correct Anvils labelled on left, leaves in order from right to left and lined up vertically, no commas																					
		B1	Correct Brecons labelled on same diagram on right hand side in order from left to right and lined up vertically, no commas																					
		B1	Correct key, not split, both teams, at least one with cm																					
		4																						
(ii)	Median = 173	B1	Correct median (or Q2)																					
	LQ = 169; UQ = 181 IQR = 181 – 169	M1	Either UQ = 181 ± 4, or LQ = 169 ± 4 and evaluating UQ – LQ																					
	= 12	A1	Correct answer from 181 and 169 only																					
		3																						
(iii)	$\Sigma x = 1923 + 166 + 172 + 182 (= 2443)$ $\Sigma x^2 = 337221 + 166^2 + 172^2 + 182^2 (= 427485)$	M1	Correct unsimplified expression for Σx and Σx^2 , may be implied																					
	Mean = $\frac{\Sigma x}{14} = \frac{2443}{14} = 174.5$	M1	Correct unsimplified mean																					
	Variance = $\frac{\Sigma x^2}{14} - \left(\frac{\Sigma x}{14}\right)^2 = \frac{427485}{14} - \left(\frac{2443}{14}\right)^2$	M1	Correct unsimplified variance using 14, their Σx and their Σx^2 , not using 1923 and/or 337221																					
	S d = 9.19	A1	Correct answer																					
		4																						

Q6

(i)	<table><tr><th>Thaters School</th><th></th><th>Whitefay Park School</th></tr><tr><td></td><td>8</td><td>3</td></tr><tr><td></td><td>8</td><td>3</td><td>4</td><td>5</td><td>7</td></tr><tr><td>8</td><td>8</td><td>7</td><td>6</td><td>4</td><td>2</td><td>5</td><td>3</td><td>6</td><td>6</td></tr><tr><td></td><td></td><td></td><td>6</td><td>2</td><td>1</td><td>6</td><td>1</td><td>4</td><td>6</td><td>9</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td>5</td><td>7</td><td>3</td><td>5</td><td>8</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td>8</td><td>3</td></tr></table>	Thaters School		Whitefay Park School		8	3		8	3	4	5	7	8	8	7	6	4	2	5	3	6	6				6	2	1	6	1	4	6	9						5	7	3	5	8							8	3	B1	Correct stem can be upside down, ignore extra values,
	Thaters School		Whitefay Park School																																																			
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		B1	Correct Thaters School labelled on left, leaves in order from right to left and lined up vertically, no commas																																																			
		B1	Correct Whitefay Park School labelled on same diagram on right hand side in order from left to right and lined up vertically, no commas																																																			
	Key 8 4 5 represents 48 minutes for Thaters School and 45 minutes for Whitefay Park School.	B1	FT Correct key for <i>their</i> diagram, need both teams identified and ‘minutes’ stated at least once here or in leaf headings or title. SC If 2 separate diagrams drawn, SCB1 if both keys meet these criteria																																																			
		4																																																				
(ii)	LQ = 50 UQ = 61.5	B1	Both quartiles correct																																																			
	IQ range = 61.5 – 50 = 11.5	B1	FT 61 ≤ UQ ≤ 62 – 48 ≤ LQ ≤ 52																																																			
		2																																																				
iii)	$\Sigma(x - 60)^2 = (-15)^2 + (-13)^2 + (-7)^2 + (-4)^2 + (-4)^2 + 1^2 + 4^2 + 6^2 + 9^2 + 13^2 + 23^2 + 15^2 + 18^2$	M1	Summing squares with at least 5 correct unsimplified terms																																																			
	= 1856	A1	Exact value																																																			
		2																																																				
(iv)	$\text{Var} = \text{mean of coded squares} - (\text{coded mean})^2$ $= \frac{\Sigma(x - 60)^2}{13} - \left(\frac{\Sigma(x - 60)}{13} \right)^2$	M1	Using two coded values in correct formula (variance or sd)																																																			
	$\text{Var} = \frac{\text{their } 1856}{13} - \left(\frac{46}{13} \right)^2$ $= 130$	A1	Correct answer SC if correct variance obtained by another method give SCB1																																																			
		2																																																				